Safety

Always observe the Manufacturers Safety Precautions and Warning Tags

- Read and follow all safety instructions given in the manufacturer's installation instructions.
- Always turn off the main power to a system before making any repairs. There may be more than one disconnect switch. If applicable, turn off the accessory power.
- **Tag and lock out all disconnect switches.**

Safety

Always observe the Manufacturers Safety Precautions and Warning Tags

- Always remove rings, watches, and other jewelry to lesson the chance of electrical shock.
- When taking voltage or continuity measurements on a compressor in a pressurized system, do not take the measurement directly at the compressor terminals.
  - Disconnect the compressor leads at the contactor to take the measurements.

Noise Complaints

INSTALLATION RECOMMENDATIONS

NOTE: In some cases noise in the living area has been traced to gas pulsations from improper installation of equipment.

1. Locate unit away from windows, patios, decks, etc. where unit operation sound may disturb customer.
2. Ensure that vapor and liquid tube diameters are appropriate for unit capacity.
3. Run refrigerant tubes as directly as possible by avoiding unnecessary turns and bends.
4. Leave some slack between structure and unit to absorb vibration.
5. When passing refrigerant tubes through the wall, seal opening with RTV or other pliable silicon--based caulk.

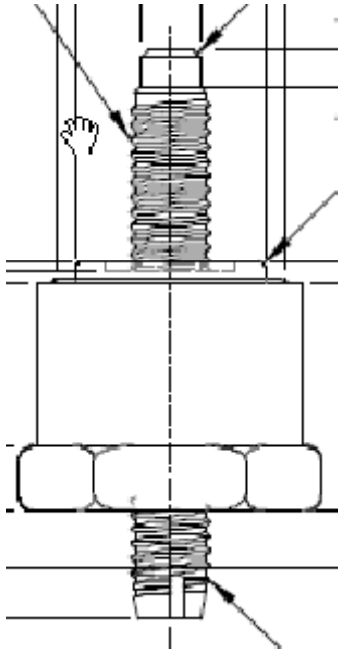
(See Fig. 1.)

6. Avoid direct tubing contact with water pipes, duct work, floor joists, wall studs, floors, and walls.
7. Do not suspend refrigerant tubing from joists and studs with a rigid wire or strap which comes in direct contact

with tubing. (See Fig. 1.)

8. Ensure that tubing insulation is pliable and completely surrounds vapor tube.
9. When necessary, use hanger straps which are 1 in. wide and conform to shape of tubing insulation. (See Fig. 1.)
10. Isolate hanger straps from insulation by using metal sleeves bent to conform to shape of insulation.

Noise Complaints



- Operational vibration could indicate a charge issue.
- Verify charge and ensure proper piping and structural penetration insulation.
- Tubing that is too rigid to building rafters without proper insulation could transfer noise throughout the structure.
- On some occasions a sound dampener or mass weight (RCD part no. 328209--751) placed on the vibrating tubing has been known to reduce this noise.
- Utilizing compressor split post grommets (see Fig) may also reduce this vibration if piping cannot be remedied.

Split Post Grommet part number: KA75UG100

Noise Complaints

• An operational high pitch frequency or “waa waa” sound that appears to resonate through the suction line could indicate a need to add more flex or muffling in the lines.
• This has been occasional in scroll compressor applications and is usually remedied by adding a field--fabricated suction line loop.
• Reciprocating compressors may have a noticeable discharge pulsation that could be remedied with a field installed discharge muffler.
• Recommend loop by continuous tubing with no more than 12 inches vertical and 6 inch horizontal loop.

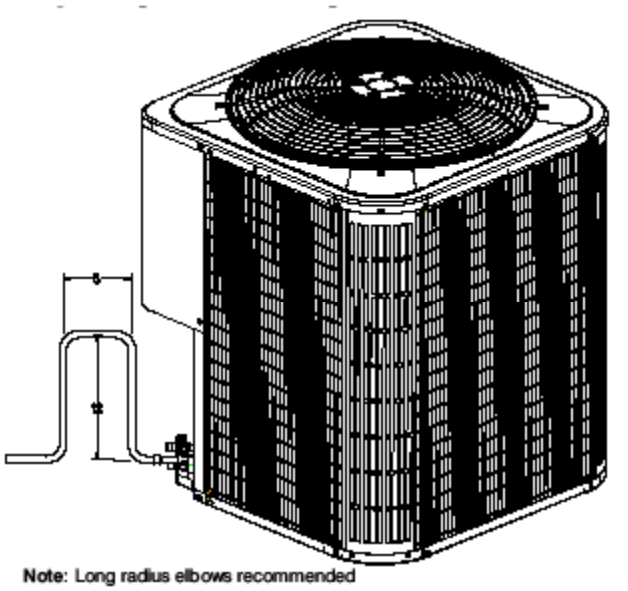
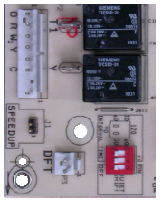


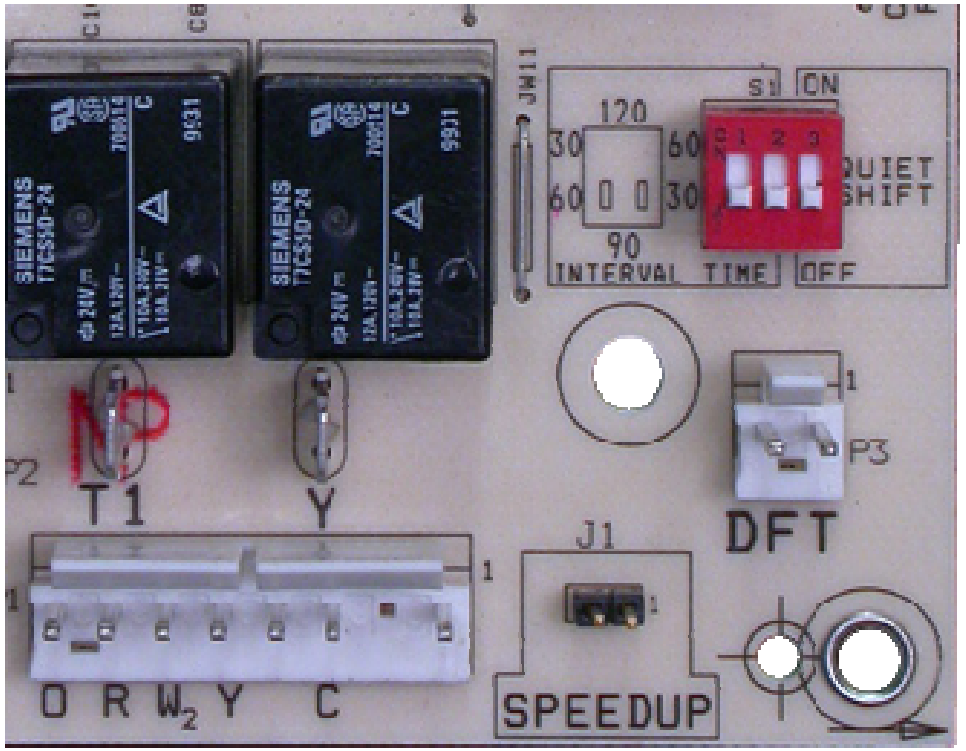
Fig. 14 – Suction Line Loop

Noise Complaints

Enable Quiet Shift or (for lower tier equipment) upgrade the defrost board to one that has the Quiet Shift feature. Quiet Shift Upgrade document to help with the process. Once Quiet Shift is enabled the compressor will stop for 30 seconds at defrost initiation and termination to prevent this noise. If defrost board is upgraded, please send me or your TM the complete model and serial so I can report it



Quiet Shift Upgrade.pdf



Noise Complaints

- Part number EF17BZ251
  - Field Solution
    - Replace With
      - EF17BZ252

- Nuisance “**<u>moose call</u>**” noise from HP going in/out of defrost.
  - Developing repeatable test to replicate the noise, each and every time
  - Supplier of reversing valve has visited and verified the noise.
  - Working to isolate the root cause of the moose call from a component to system solution.
  - Issue appears to be a flow related noise that occurs after the mid point of the shift coming out of defrost.

Reversing Valve Troubleshooting

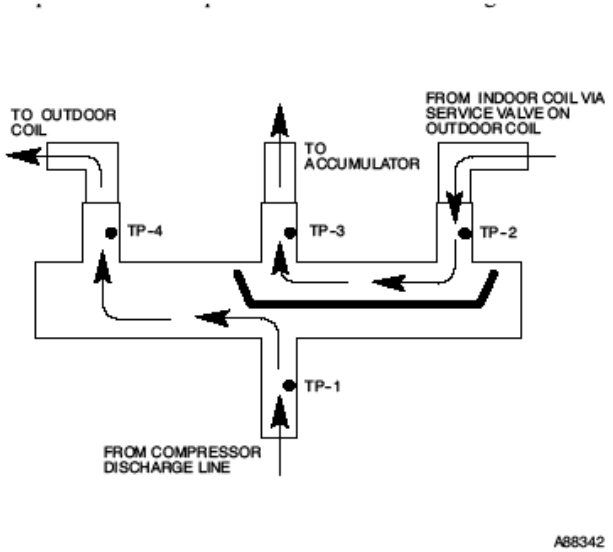


Fig. 21 – Reversing Valve
(Cooling Mode or Defrost Mode, Solenoid Energized)

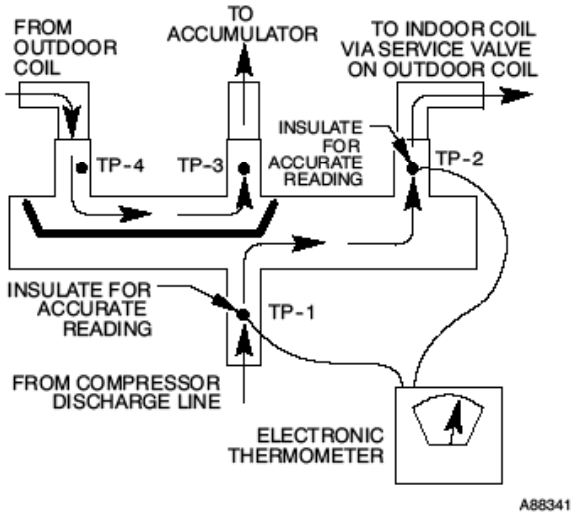


Fig. 22 – Reversing Valve
(Heating Mode, Solenoid De-Energized)

Light Commercial Split

A Bi-Flow kit must be added to the LLSV to convert them to heat pump operation.

Ordering Number	Liquid Line Size	Mfg Part Number	Used on	Sight Glass
EF680033	3/8”	ALC-066208	AUQ07, 575Jx07, CHS07	HMI-1TT3
EF680034	1/2”	ALC066209	AUQ08-12, 575Jx08-12, CHS091-121	HMI-1TT4
EF680037	Solenoid Coil Assy	AMG-24/5060	All units	
EF680039	Bi-Flow Kit	ALC066224	All Heat Pumps	

SuperHeat

Normal / 5-20˚

10psig = 4.3˚ (average based on SST range/29.5˚-55.1˚)

Table 7—Puron System Suction Pressure Drop

Nominal Size (Btuh)	Suction Line OD (in.)	Pressure Drop (psi/100 ft)	Suction Velocity fpm	Puron Suction Line Pressure Drop (psig) Total Equivalent Line Length (ft)									
				20	50	80	100	125	150	175	200	225	250
18000	1/2	9.9	1649	2	5	8	10	12	15	17	20	22	25
	5/8	3.1	1018	1	2	2	3	4	5	5	6	7	8
	3/4	1.2	678	0	1	1	1	1	2	2	2	3	3
24000	1/2	16.7	2199	3	8	13	17	21	25	29	33	38	42
	5/8	5.2	1357	1	3	4	5	7	8	9	10	12	13
	3/4	2.0	904	0	1	2	2	2	3	3	4	4	5
	7/8	1.0	678	0	0	1	1	1	1	2	2	2	2
30000	5/8	7.8	1696	2	4	6	8	10	12	14	16	18	20
	3/4	2.9	1130	1	1	2	3	4	4	5	6	7	7
	7/8	1.5	848	0	1	1	1	2	2	3	3	3	4
36000	5/8	10.9	2036	2	5	9	11	14	16	19	22	24	27
	3/4	4.1	1356	1	2	3	4	5	6	7	8	9	10
	7/8	2.0	1017	0	1	2	2	3	3	4	4	5	5
42000	5/8	14.1	2375	3	7	11	14	18	21	25	28	32	35
	3/4	5.4	1582	1	3	4	5	7	8	9	11	12	14
	7/8	2.7	1187	1	1	2	3	3	4	5	5	6	7
	1 1/8	0.8	696	0	0	1	1	1	1	1	2	2	2
48000	3/4	6.9	1808	1	3	6	7	9	10	12	14	16	17
	7/8	3.5	1357	1	2	3	3	4	5	6	7	8	9
	1 1/8	1.0	796	0	0	1	1	1	1	2	2	2	2
60000	3/4	10.4	2260	2	5	8	10	13	16	18	21	23	26
	7/8	5.2	1696	1	3	4	5	6	8	9	10	12	13
	1 1/8	1.4	995	0	1	1	1	2	2	3	3	3	4

Line set application not recommended

Fitting Losses

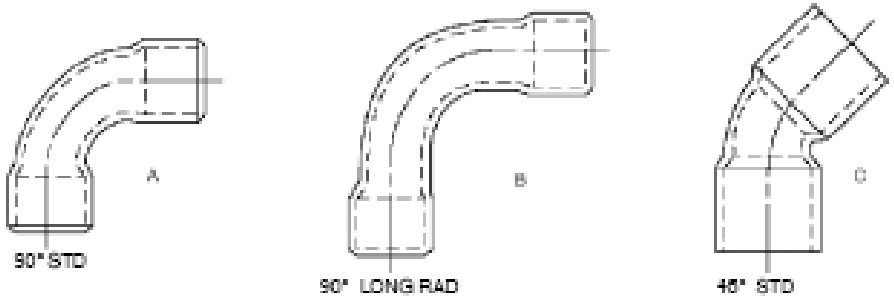


Fig. 32 – Tube Fitting Geometry

Table 6—Fitting Losses in Equivalent Feet

TUBE SIZE OD (IN.)	FITTING – REFERENCE DIAGRAM IN FIGURE 34		
	90° STD (A)	90° LONG RAD (B)	45° STD (C)
1/2	1.2	0.8	0.6
5/8	1.6	1.0	0.8
3/4	1.8	1.2	0.9
7/8	2.0	1.4	1.0
1–1/8	2.6	1.7	1.3

Outdoor Heat Pump - Piston Resizing

Table 5	R–410A Maximum Equivalent Length (feet) – Outdoor Unit Below Indoor Unit						
Model Size	Vertical Separation (feet)						
	0 – 20	21 – 30	31 – 40	41 – 50	51 – 60	61 – 70	71 – 80
18 (1½ ton)	250	250	250	250	250	250	250
24 (2 ton)	250	250	250	250	250	250	250
30 (2½ ton)	250	250	250	250	250	250	250
36 (3 ton)	250	250	250	250	250	250	250
42 (3½ ton)	250	250	250	250	250	250	150
48 (4 ton)	250	250	250	250	230	160	--
60 (5 ton)	250	225	190	150	110	--	--

(--) Dashes indicate vertical separation exceeds allowable limits.

Table 6	R–410A Heat Pump Outdoor Piston Change – Outdoor Unit Below Indoor Unit						
Model Size	Vertical Separation (feet)						
	0 – 19	20 – 29	30 – 39	40 – 49	50 – 59	60 – 69	70 – 79
18 (1½ ton)	0	– 1	– 1	– 2	– 2	– 2	– 2
24 (2 ton)	0	– 1	– 1	– 2	– 2	– 3	– 3
30 (2½ ton)	0	– 1	– 1	– 2	– 2	– 3	– 3
36 (3 ton)	0	– 1	– 2	– 2	– 2	– 3	– 3
42 (3½ ton)	0	– 1	– 2	– 2	– 3	– 3	– 4
48 (4 ton)	0	– 1	– 2	– 2	– 3	– 3	--
60 (5 ton)	0	– 1	– 2	– 3	– 3	--	--

(--) Dashes indicate vertical separation exceeds allowable limits.

Outdoor Heat Pump Unit - Piston Resizing

Table 7	R-410A Heat Pump Outdoor Piston Change – Outdoor Unit Above Indoor Unit							
Model Size	Vertical Separation (feet)							
	20 – 25	26 – 50	51 – 75	76 – 100	101 – 125	126 – 150	151 – 175	176 – 200
18 (1½ ton)	+ 1	+ 1	+ 2	+ 3	+ 3	+ 4	+ 5	+ 6
24 (2 ton)	+ 1	+ 1	+ 2	+ 3	+ 4	+ 5	+ 6	+ 7
30 (2½ ton)	+ 1	+ 2	+ 2	+ 4	+ 5	+ 6	+ 8	+ 9
36 (3 ton)	+ 1	+ 2	+ 2	+ 4	+ 5	+ 6	+ 8	+ 9
42 (3½ ton)	+ 1	+ 2	+ 3	+ 4	+ 5	+ 7	+ 8	+ 10
48 (4 ton)	+ 1	+ 2	+ 3	+ 4	+ 5	+ 7	+ 9	+ 10
60 (5 ton)	+ 1	+ 2	+ 3	+ 5	+ 6	+ 8	+ 10	+ 12

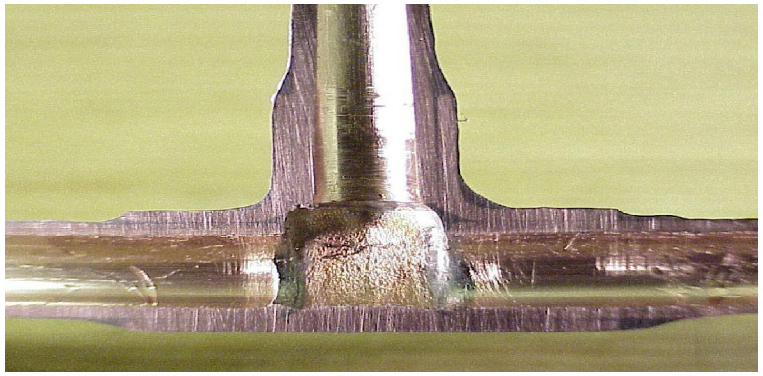
Fault Code Review

OPERATION	FAULT	AMBER LED FLASH CODE	POSSIBLE CAUSE AND ACTION
Standby – no call for unit operation	None	On solid, no flash	Normal operation
Emergency Mode – Model 25HNA9/24ANA1 only	Standard Thermostat Control (25HNA9/24ANA1 only)	Rapid, continuous flashing	Unit being controlled by standard thermostat inputs instead of Infinity Control. Only high stage operation is available. This operating mode should be used in emergency situations only.
Low Stage Cool/Heat Operation	None	1, pause	Normal operation
High Stage Cool/Heat Operation	None	2, pause	Normal operation
	System Communications Failure	16	Communication with User Interface lost. Check wiring to UI, indoor and outdoor units
	Invalid Model Plug	25	Control does not detect a model plug or detects an invalid model plug. Unit will not operate without correct model plug.
	High Pressure Switch Open	31*	High–pressure switch trip. Check refrigerant charge, outdoor fan operation and coils for airflow restrictions.
	Low Pressure Switch Open	32*	Low–pressure switch trip. Check refrigerant charge and indoor air flow.
	Control Fault	45	Outdoor unit control board has failed. Control board needs to be replaced.
	Brown Out (230v)	46	Line voltage =< 187v for at least 4 seconds. Compressor and fan operation not allowed until voltage>=190v. Verify line voltage.
	No 230v at Unit Measured at L1 and L2 on circuit board	47	There is no 230v at the contactor when indoor unit is powered and cooling/heating demand exists. Verify the disconnect is closed and 230v wiring is connected to the unit.
	Outdoor Air Temp Sensor Fault	53	Outdoor air sensor not reading or out of range. Ohm out sensor and check wiring.
	Outdoor Coil Sensor Fault	55	Coil sensor not reading or out of range. Ohm out sensor and check wiring.
	Thermistors out of range	56	Improper relationship between coil sensor and outdoor air sensor. Ohm out sensors and check wiring.
	Low Stage Thermal Cutout	71*	Compressor operation detected then disappears while low stage demand exists. Possible causes are internal compressor overload trip or start relay and capacitor held in circuit too long (if installed).

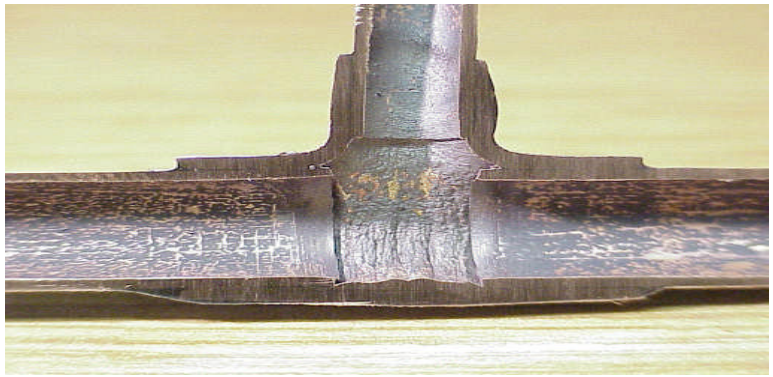
Fault Code Review

	High Stage Thermal Cutout	72*	Compressor operation detected then disappears while high stage demand exists. Possible causes are internal compressor overload trip or start relay and capacitor held in circuit too long (if installed).
	Contactor Shorted	73*	Compressor voltage sensed when no demand for compressor operation exists. Contactor may be stuck closed or there is a wiring error.
	No 230V at Compressor (25HNA9 Only)	74	Compressor voltage not sensed when compressor should be starting. Contactor may be stuck open or there is a wiring error.
	Low Stage Did Not Start (25HNA6 Only)	75	Specified start voltage at VR terminal was not achieved in low stage. Start relay was de-energized after 1 second.
	Low Stage Did Not Start 3 times (25HNA6Only)	76	For 3 consecutive low stage starts, the specified start voltage at VR terminal was not achieved & start relay was de-energized. Low stage locked out for 30 minutes.
	High Stage Did Not Start (25HNA6 Only)	77	Specified start voltage at VS terminal was not achieved in high stage. Start relay was de-energized after 1 second.
	High Stage Did Not Start 3 times (25HNA6 Only)	78	For 3 consecutive high stage starts, the specified start voltage at VS terminal was not achieved & start relay was de-energized. High stage locked out for 30 minutes.
	Low Stage Thermal Lockout	81	Thermal cutout occurs in three consecutive low/high stage cycles. Low stage locked out for 4 hours or until 24v power recycled.
	High Stage Thermal Lockout	82	Thermal cutout occurs in three consecutive high/low stage cycles. High stage locked out for 4 hours or until 24v power recycled.
	Low-Pressure Lockout	83	Low pressure switch trip has occurred during 3 consecutive cycles. Unit operation locked out for 4 hours or until 24v power recycled.
	High-Pressure Lockout	84	High pressure switch trip has occurred during 3 consecutive cycles. Unit operation locked out for 4 hours or until 24v power recycled.
	Low Contactor Open (25HNA6 Only)	85	Compressor voltage not sensed when compressor should be starting. Low stage contactor may be stuck open or there is a wiring error.
	High Contactor Open (25HNA6 Only)	87	Compressor voltage not sensed when compressor should be starting. High stage contactor may be stuck open or there is a wiring error.

Using Nitrogen Is Not Optional



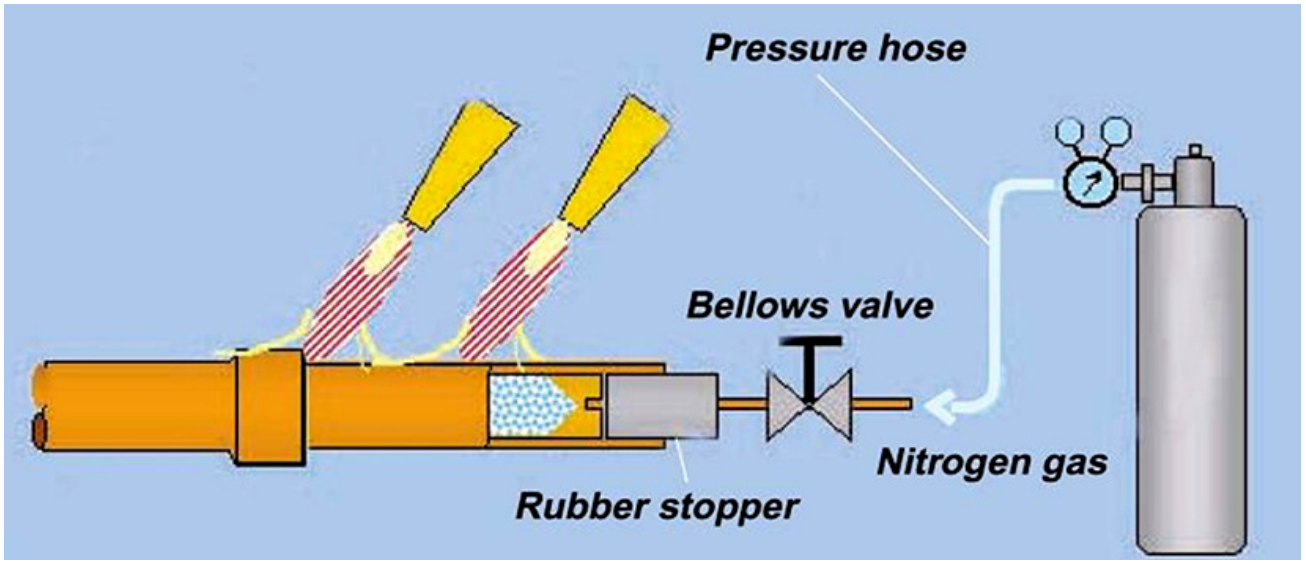
- Use of nitrogen during brazing



Carbon deposits resulting from not using nitrogen during brazing

Brazing

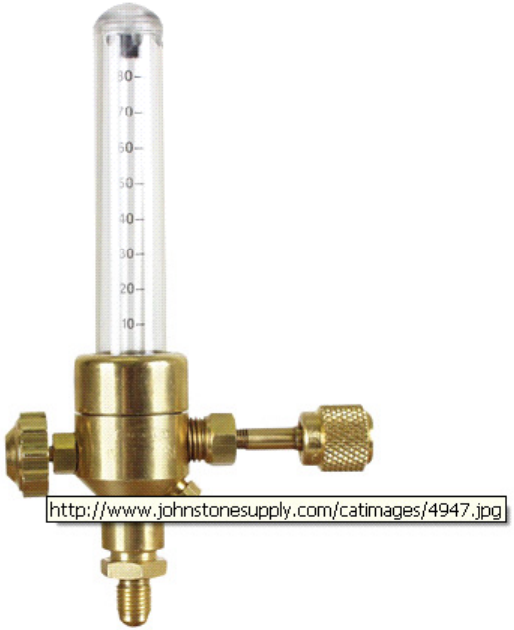
- Purge with nitrogen while brazing
- Nitrogen prevents carbon that can be washed with POE oil and can cause restrictions and oil decomposition



Part# UNF3 / $55.00

- Store home
- Pumps
- Electric motors
- HVAC
- Precision Controls,Measuring
- Refrigeration,
- Power tools
- Hand Tools
- Heating Elements
- Appliance parts
- Other

UNIWELD UNF3 Nitrogen Flowmeter NEW



- Low-pressure nitrogen gas must be flowing through the copper lines when brazing to eliminate scale and oxidation that can cause blockage in a system
- A flowmeter works in conjunction with a regulator to accurately calibrate the outlet pressure while monitoring the flow of gas; a regulator can be adjusted to deliver low pressure, but by itself, won't tell you in nitrogen is flowing
- A nitrogen flowmeter has a float ball that rises in the flowmeter tube indicating low-pressure flow of nitrogen when purging copper lines during the brazing process
- 1/4" flare outlet connection; attaches directly to any nitrogen regulator with a 1/4" male flare outlet fitting

FB4CNF018-060 & piston use

DSB 10-0008 provides most of the information needed to answerer these questions.

DSB 10-0008.pdf

This document is the highlight slide from the Spring Update class on the FB4C.

FB4 Update Class Slide.pdf

Picture examples of the indoor (cooling) and outdoor (heating) pistons. Notice the note on the bottom of slide 1 (You may use FB4C's as a R-22 fan coil replacement by removing the R410a piston and re-installing the R-22 piston that was in the old Carrier, Bryant or Payne fan coil.)

FB4C_Piston Models.pdf

FB4CNF018-060 & piston use

Current Super Heat chart for use with a cooling piston as the older slide charts are not compatible with the current product.

New_HP_Superheat_Chart.doc

Part number and drill size of old style and new style pistons

Piston_Models.xls

Additional outdoor units (including piston size) approved to be used with the FB4C, with a piston, since the release of DSB10-0008.

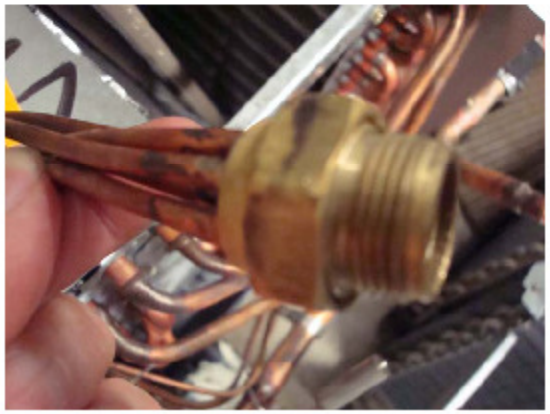
Pistons by ıdel_05_08_2010.x

Remember to **always** check PD for proper matches and ratings.

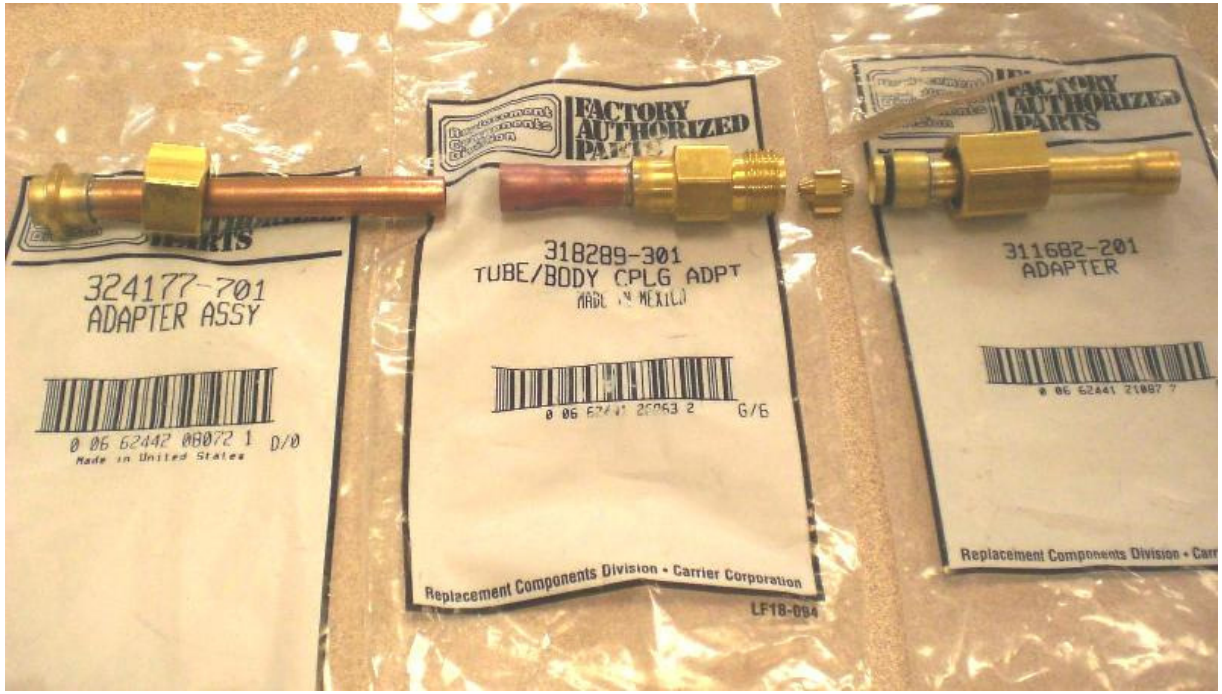
Furnace Coil Conversion

Carrier Factory Installed
R410a TXV Furnace Coil

When converting you must weld shut equalization connection



Furnace Coil Conversion



Convert a current production 410A furnace coil back to R22 in order to satisfy a customers in warranty request.

Action: Reuse the old piston that was in the original R22 evaporator coil. Solder the equalizer tube closed at the suction header tube.

RCD part numbers :	Description	Usage location
324177-701	Adapter Assembly	Attach to the new 410A distributor assembly
318289-301	Tube / Body Coupling Adapter	Body to hold the piston
311682-201	Adapter	Piston retainer & liquid line connection

Furnace Coil Conversion

R410a TXV to R-22 Accurater (Carrier Furnace Coil Conversion)

Useful Service Manuals

Residential


Residential 2009 Piping - Long...


Fan Coil Service Manual 6sm.pd...


Mobile Home P-AC Small Packag


Res Split HP-AC Service Manual...

Light Commercial


48TC 15-25 Ton Service Manual....


50TC 3-10 Ton Service Manual.p..


50TCQ 3-8.5 on Service Manual.

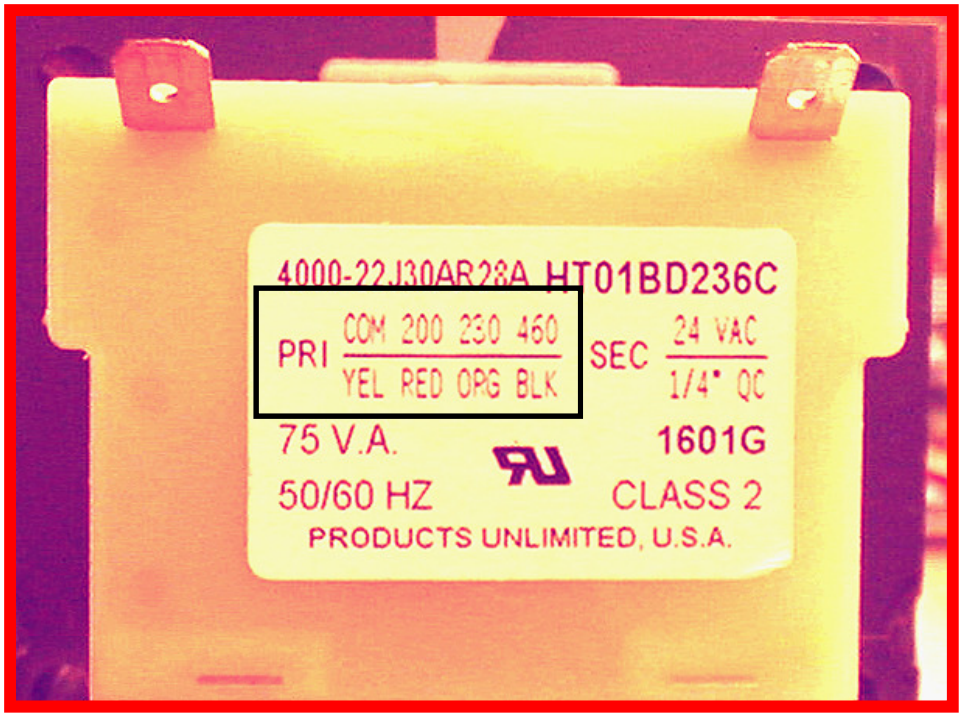
Review

Tips / Low Voltage

Multi-Voltage Transformer

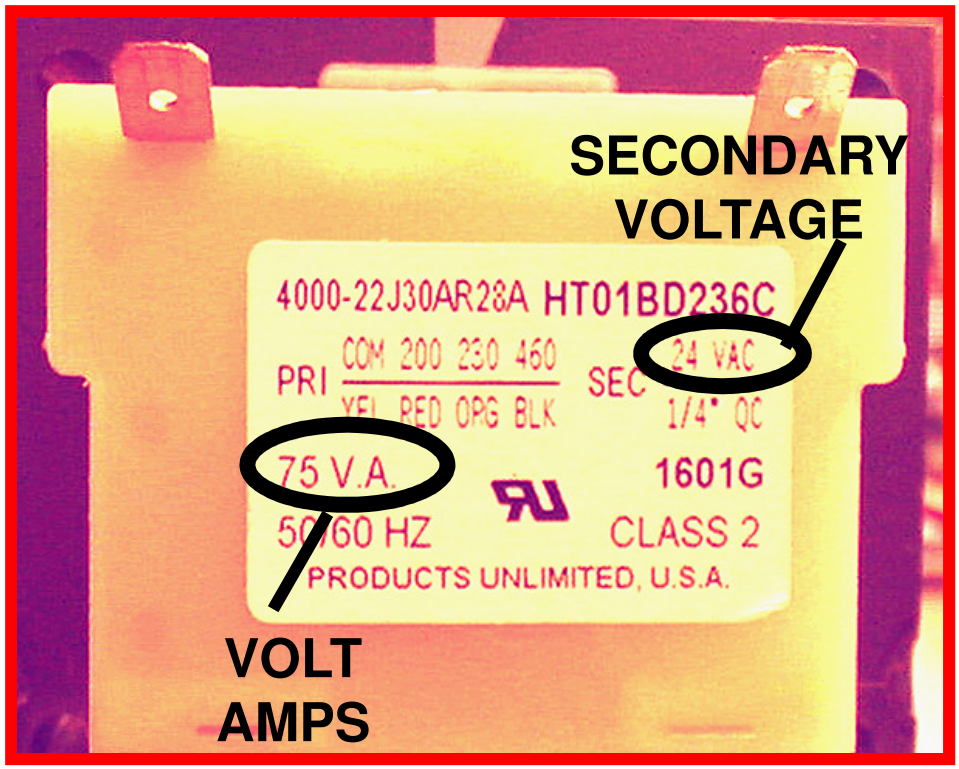
Check to see that the Control Transformer Primary Connection is tapped for the correct voltage

When tapped for the wrong primary: Secondary voltage and / or Current will be effected!



Tips / Low Voltage

$$\text{Total Available Amp Draw Of a Circuit} = \frac{\text{Volt Amps}}{\text{Secondary Voltage}}$$



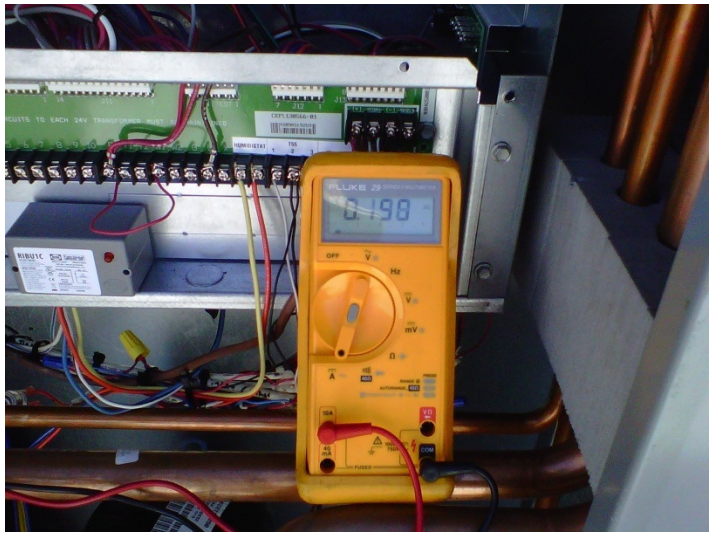
$$\frac{75 \text{ V.A.}}{24 \text{ VAC}} = 3.125 \text{ Amps}$$

Actual operating VAC will be more accurate.

Tattle Tales

- Parts to make your own can be purchased at Radio Shack
  - 1 ¼" X ¼" in-line fuse holder
  - 1 ¼" X ¼" glass fuse

- Measure the circuit current to determine fuse size



Tips / Air, Acid, & Moisture

Vacuum Pump Maintenance

- The oil used in a vacuum pump can quickly become contaminated. On average it should be changed after every 10 hours of operation or immediately after evacuating a wet or contaminated system.
- All quality vacuum pumps have a gas ballast that should be opened during the early stages of an evacuation.

Tips / Charging Techniques

Weigh in Method

When can you use this method?

Anytime

What is the unit charged for from the factory?

15 feet

How much do you add per foot of line set?

.6 oz/ft Note: 16 oz/lb

Note: You must be using the standard line set size for the unit and not have greater than 80 ft EL of tubing. Otherwise this method will not be accurate.

Example:
You have unit with 60 ft of line set (assume proper diameters). How much charge should be added?

60 ft – 15 ft = 45 ft 45 ft x .6 oz/ft = 27 oz. 27oz. X 1 lb/16oz. = 1.69 lbs

Tips / Charging Techniques

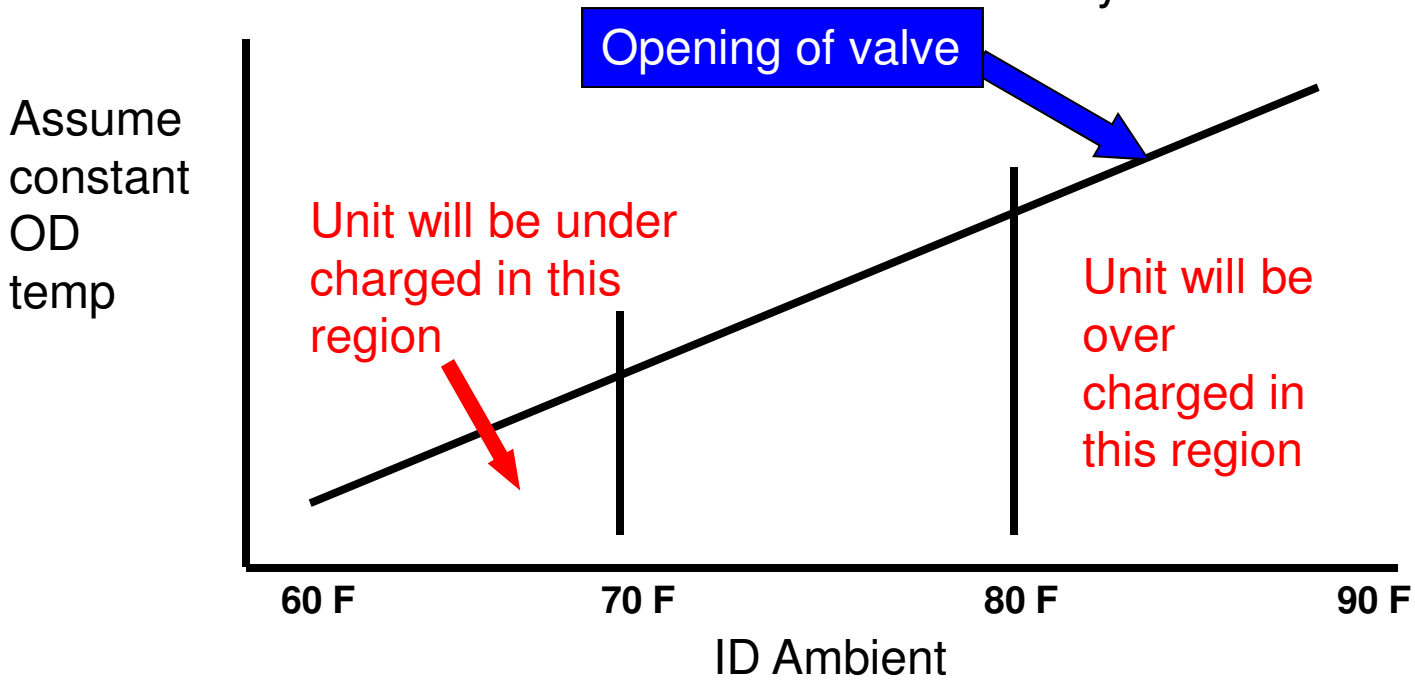
Sub Cooling Method

When can you use this method?

- When using a TXV
- OD amb between 70 and 100 F
- ID amb between 70 and 80 F

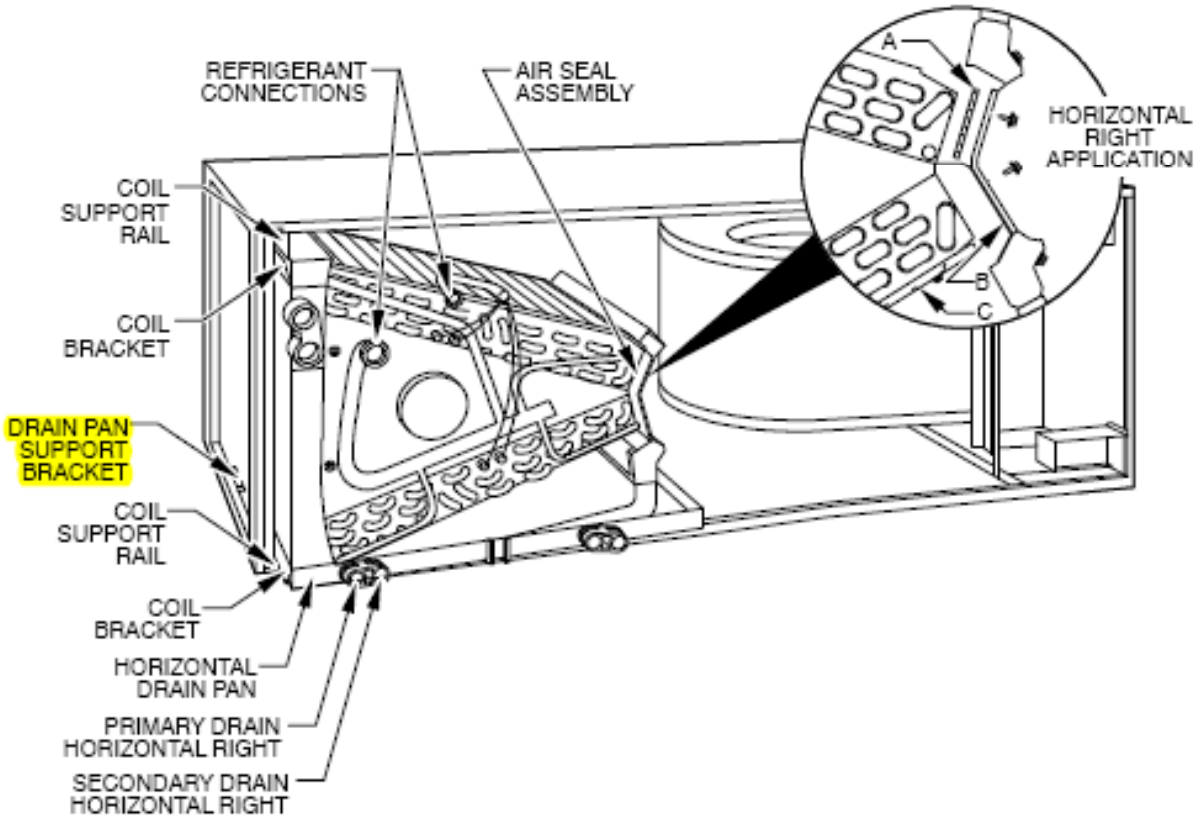
Important Steps

- Must let unit run for 15 mins minimum
- Charge must be added in short cycle intervals.



Fan Coil Conversion

Don’t forget the Drain Pan Support Bracket



Duct Sweating

-First we need to understand the problem!!

-To resolve sweating we must understand how to evaluate the problem.

Dew Point

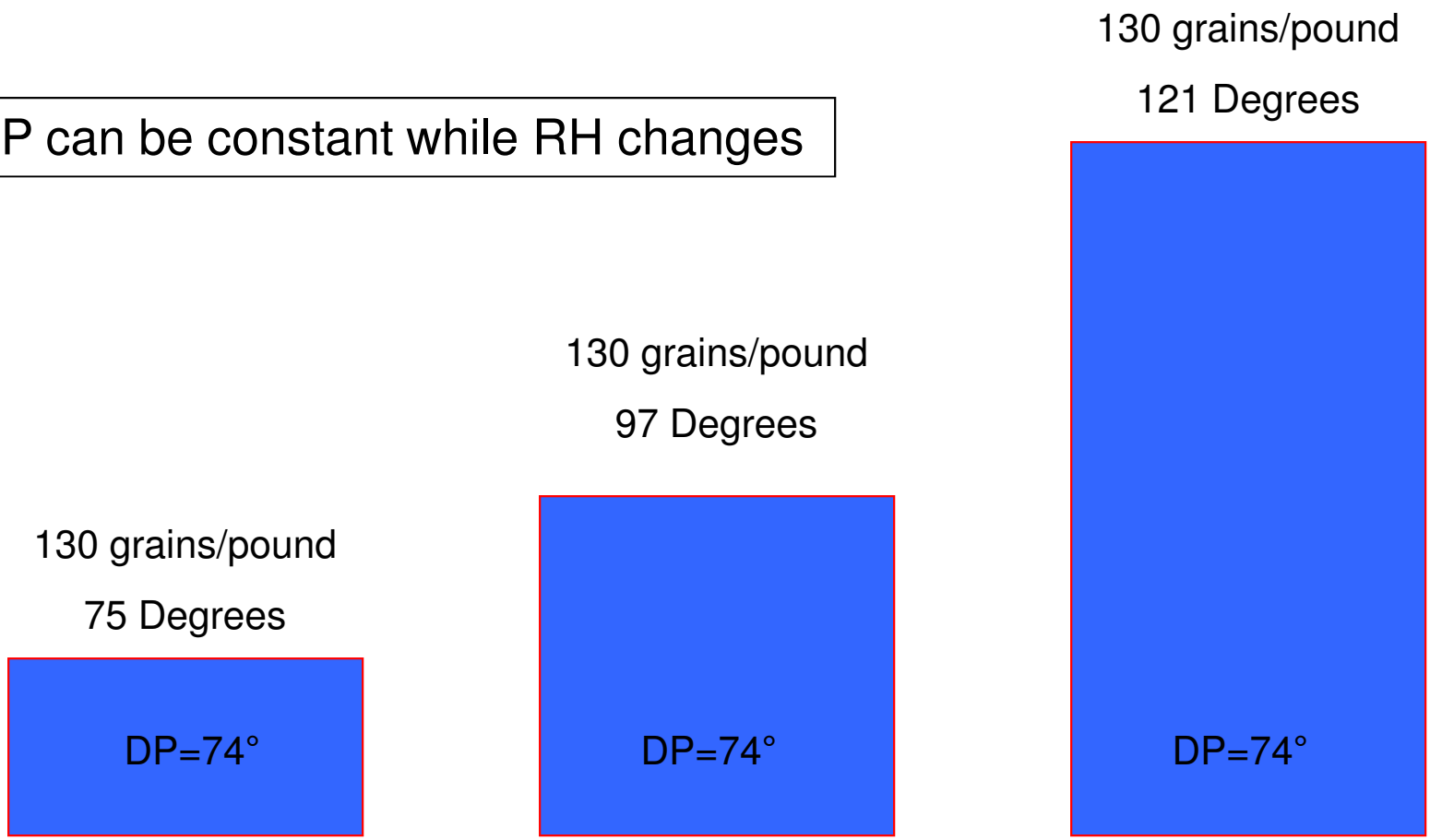
- Dew Point is the temperature at which condensation forms. When air comes in contact with a surface that is at or below its Dew Point temperature, condensation will form on that surface.
- Dew Point calculation?

Duct Sweating

- All this means is that if condensation is forming, the surface on which it is forming is below Dew Point.
- To prevent the condensation, the surface must be above Dew Point
- Dew Point in a attic can easily be above 80°
- Can the insulation surface temperature be below 80°? YES!!

Dew Point & Relative Humidity

DP can be constant while RH changes



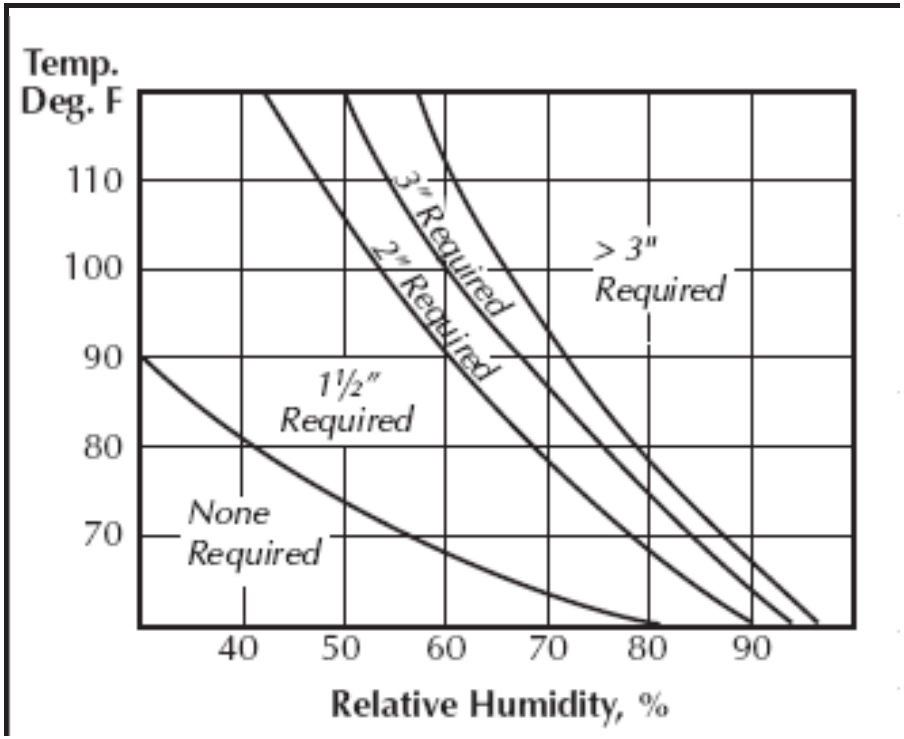
Duct Sweating

Dew Point Table

% Relative Humidity

Air Temp °F	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10
110	110	108	106	104	102	100	98	95	93	90	87	84	80	76	72	65	60	51	41
105	105	103	101	99	97	95	93	91	88	85	83	80	76	72	67	62	55	47	37
100	100	99	97	95	93	91	89	86	84	81	78	75	71	67	63	58	52	44	32
95	95	93	92	90	88	86	84	81	79	76	73	70	67	63	59	54	48	40	32
90	90	88	87	85	83	81	79	76	74	71	68	65	62	59	54	49	43	36	32
85	85	83	81	80	78	76	74	72	69	67	64	61	58	54	50	45	38	32	
80	80	78	77	75	73	71	69	67	65	62	59	56	53	50	45	40	35	32	
75	75	73	72	70	68	66	64	62	60	58	55	52	49	45	41	36	32		
70	70	68	67	65	63	61	59	57	55	53	50	47	44	40	37	32			
65	65	63	62	60	59	57	55	53	50	48	45	42	40	36	32				
60	60	58	57	55	53	52	50	48	45	43	41	38	35	32					
55	55	53	52	50	49	47	45	43	40	38	36	33	32						
50	50	48	46	45	44	42	40	38	36	34	32								
45	45	43	42	40	39	37	35	33	32										
40	40	39	37	35	34	32													
35	35	34	32																
32	32																		

Insulation required to prevent condensation



Possible contributing factors

- Low airflow / causes a cold coil and Low SAT
  - Zoning bypass open for long periods can cause the same
- Low insulation R-value
  - Wet insulation
  - Wrap not properly installed / to tight
  - Wrap the supply plenum and add duct liner
  - Wrap the fan/coil
  - Use mesh hanging material under duct wrap and seal penetration with mastic
  - Hanging duct helps with evaporation and insulation compression
    - If attic temp is high and RH is low, evaporation helps prevent duct sweating
  - Install duct wrap over damper actuators

Possible contributing factors

- Leaking duct
  - Air leaks in the SA will cause the insulation to be well below DP
- Extremely high Dew Point / Look for possible contributors:
  - Power Attic Ventilators / Disable them – PAV's introduce more moisture into the attic and keep it cooler causing a higher RH and less evaporation. PAV's generally cause moisture infiltration into the conditioned space.

Sweating Bottom Line

- Hotter is better. The hotter the attic, the warmer the surface temperatures and the lower the RH.
  - Warmer surface temperatures – less likely to be below Dew Point
  - Lower RH – Better chance for condensation to evaporate.
  - Hanging duct helps, so don't lay it on the attic floor!

Problems When Resizing Equipment

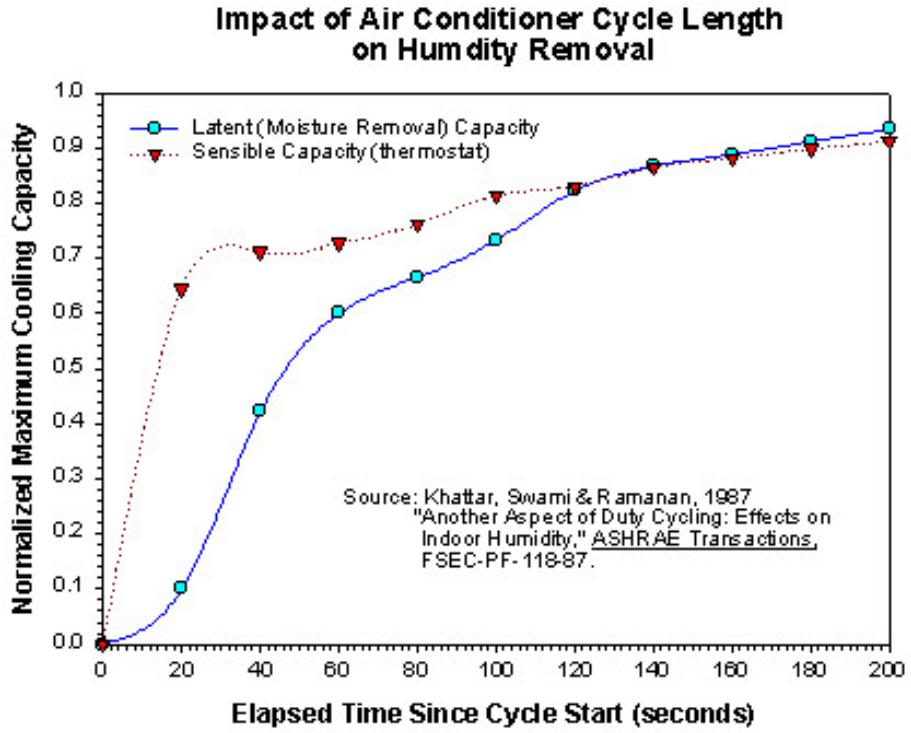
- Customer perceptions—"Why do I have 3 tons when my neighbor has 5 tons?" Opportunity

  Explain longer run cycle = better life, efficiency, and humidity control @ a higher set point
- Customer complaint—"Why is my equipment running so long? Its never done that before."

  Must be explained Pre-sale
- Greater vulnerability to poorly installed systems - duct leakage, improper refrigerant charge, or low airflow.
- Higher recovery times from deep setbacks - instruct customers to "set & forget" thermostats.

Correct equipment selection

Higher Seer upgrade – more than just an efficiency change. Higher SEER, non variable speed fan/coils have a reduced latent capacity when compared to a less efficient system. (bigger-warmer evap coil)



On average it takes a 13 SEER system 10–15 minutes to obtain full latent capacity,

Compared to 5-7 minutes for a 10SEER system

- Variable speed has a fan on delay
- Infinity / Evolution has a reduced fan speed for the first 10 minutes of operation and no fan off delay in the cooling mode
- Two stage equipment will have a much longer run cycle than single stage

No load humidity control

- Supplemental dehumidification system
  - Used to control indoor humidity when there is no sensible load.
    - Cool, cloudy, and/or rainy days. Also at night.
  - A better option than lowering the cooling set point
    - This will actually raise the RH and cause possible condensation of the structure